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Construction Equipment Monitoring: By using Relative Important Indices (RII) Analysis

Mr. V. D. Sakhare[1], Dr. M. B. Chougule[2]

[1]Assistant Professor, [2]Associate Professor,
[1,2]Department of Civil Engineering,
[1,2]DKTE Society's Textile & Engineering Institute, Ichalkaranji, Maharashtra, India

ABSTRACT

During the construction phase, selection of right equipment is a important key factor in the success of any construction project. Equipment usage will give fast and accurate results at a reduced cost. Advantage of equipment utilization includes increased rate of output, reduction in overall cost, carrying out activities that cannot be carried out manually etc. Thus proper choice and use of the equipment contributes to quality, economy, safety, speed and timely completion of the project. But the selection of most appropriate equipment from the available options is highly challenging. Therefore, this paper aims to determine a selection criteria based on the fundamental concept of sustainability and provides an assessment framework.

KEYWORDS: *selection of right equipment; Selection criteria; sustainability; assessment framework*

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1. INTRODUCTION

The improper selection and use of equipment can cause excessive costs, time and injuries to labors. Time required for equipment work depends on the performance of equipment. There are various factors that can affect equipment's performance and productivity. All construction projects require different types of equipment and machineries having their own level of application. For example residential projects have a low level of equipment usage. It requires simple and traditional machines like backhoes, hauling and hoisting equipment, material handling along with pneumatic tools.

Commercial projects have moderate usage of equipment and machineries. Industrial and heavy construction projects required high utilization of machinery for carrying out mass excavation, stabilizing, compacting, asphalt paving and finishing, pipelines, railroads and many other special activities. Good equipment management in construction projects is strongly possible with the efficient utilization of equipment. the most appropriate equipment from the available options is highly challenging. Therefore, this paper aims to determine a selection criteria based on the fundamental concept of sustainability and provides an assessment framework.

2. Objectives

In this paper it is proposed to do the following work,

A. To study the equipment optimization and benefit analysis at the site through equipment production analysis
B. To do survey of various construction companies for their equipment management strategies on the basis of economy.
C. To study the different costs affecting the economy in construction.
D. To identify how to improve a economy of Construction equipment.

3. Methodology:

Ranking Criteria for Effective Equipment Management

In consultation with top management of organizations associated with case study and other experts and their past experience from similar kind of projects, following Relative Importance Indices (RII) were identified for analysis with respect to projects/sites. For the research undertaken, it is to be observed that feedbacks were received on a (1 – 5) Likert scale. Therefore, use of parametric methods is not practicable and applicable for assessing preferences of the respondents so, relative importance index method was used for determining the relative importance of sustainable criteria.

Relative Importance Index (RII) is a non-parametric technique widely used by construction and facilities management researchers for analyzing structured questionnaire responses for data involving ordinal measurement of attitudes.

For this part of the questionnaire, the five-point Likert scale of 1 to 5
1 = not at all important,
2 = low important,
3 = neutral,
4 = very important
5 = extremely important

This adopted and the Relative Importance Indices (RII) for each of the sustainable criteria. Formula for finding RII for each of sustainable criteria is as follows,

$$RII = \frac{\sum W}{A \times N}$$

Where, W = weighting that is assigned to each variable by the respondent,
A = highest weight and
N = total number of respondents.

The RII value ranges from 0 to 1 with 0 not inclusive. It shows that higher the value of RII, more important was the sustainable criteria and vice versa. The comparison of RII with the corresponding importance level is measured from the transformation matrix as proposed by Chen et al. (2010).

According to him, derived importance levels from RII are as follows:

High (H) 0.8 < RII < 1.0
High-Medium (H-M) 0.6 < RII < 0.8
Medium (M) 0.4 < RII < 0.6
Medium-Low (M-L) 0.2 < RII < 0.4
Low (L) 0.0 < RII < 0.2
High (H) 0.8 < RII < 1.0

Table: Importance Level from RII

Table shows the Relative Importance Index (RII) of the sustainable criteria along with the corresponding ranking and their importance level. Ratings opinions on 5-point Likert Scale on the following criteria in terms of their importance in the selection of onsite mechanical equipments and in relation to sustainable criteria.

4. Analysis and Results:

Relative Importance Indices (RII)

Case study, different experts from the construction industries and their past experience from similar kind of projects, following Relative Importance Indices (RII) were identified for analysis.

1. Name of Organization- Sanskruti & Associates

$$RII = \frac{W}{A \times N}$$

$$= \frac{174}{5 \times 38}$$

=0.915

2. Name of Organization- Sawant & Associates

$$RII = \frac{W}{A \times N}$$

$$= \frac{145}{5 \times 38}$$

=0.763

3. Name of Organization- Patil-Bhagwat Developers

$$RII = \frac{W}{A \times N}$$

$$= \frac{164}{5 \times 38}$$

=0.863

4. Name of Organization- Swati Construction

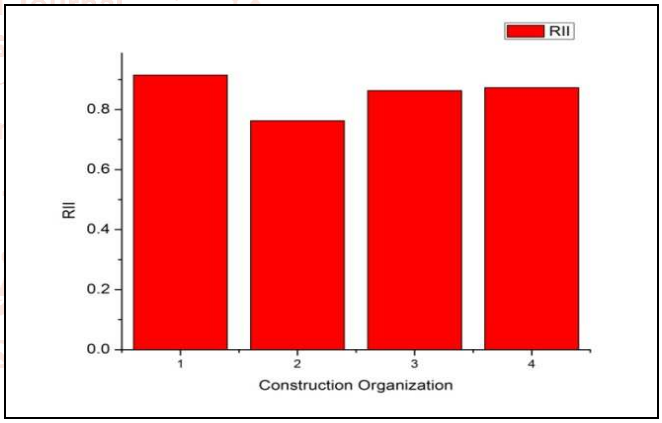
$$RII = \frac{W}{A \times N}$$

$$= \frac{166}{5 \times 38}$$

=0.873

Sr. No	Name of Organization	RII	Importance Level
1	Sanskruti Associates	0.915	High (H)
2	Sawant Associates	0.763	High to Medium (H-M)
3	Patil-Bhagwat Developers	0.863	High (H)
4	Swati Construction	0.873	High (H)

Table: Relative Important Indices



Graph: RII of sample Construction organizations.

5. Conclusion:

A. Only one third of the construction industries were found to have documented policies, it was found that there is a uniform practice of management among industries, which indicates that there is a policy for management although it is not properly documented.
B. Incorrect equipment selection may directly affect to its productivity for that particular work. Eg. Excavation is generally faster for soft soil as compared to hard strata.
C. Greater angle of swing results in greater cycle time which may lead the work to delay.
D. Time saved per cycle is nothing if the operator's skill is poor.
E. The choice for equipment will vary case by case depending upon terrain, task, time of completion of project and construction cost.

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